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## ABSTRACT

Friction was measured at 25°C for steel sliding on polytetrafluoroethylene (TFE), a copolymer of tetrafluoroethylene and hexafluoropropylene (FEP), three high-density polyethylenes (HDP), and two low-density polyethylenes (LDP) at a velocity of 0.01 cm/sec and with a load of 1000 grams. The static coefficient of friction ( $\mu_s$ ) with a clean steel slider for all the polymers and the kinetic coefficient of friction ( $\mu_k$ ) for LDP are of the order predicted by the adhesion theory. The experimental values of  $\mu_k$  are much smaller than the calculated values with TFE, FEP, and HDP because of the low specific adhesion between these polymers and their films which have transferred to the steel slider. The value of  $\mu_k$  for FEP was found to be greater than that of TFE by a factor of three. Similarly,  $\mu_k$  for LDP was three times that of HDP. These large differences are explained by the differences in the nature of the transferred polymer films and real areas of contact. All these polymers are potentially excellent dry-film lubricants when used as thin films on a hard backing.

Friction was also determined for FEP as a function of the load in the range 100 to 10,000 grams. Static friction was not proportional to the load and  $\mu_s$  increased rapidly as the load was decreased below 1000 grams. It was concluded that the real area of contact was not proportional to the load and that the deformation of contacting asperities was not completely plastic.

## PROBLEM STATUS

This is an interim report; work on this problem is continuing.

## AUTHORIZATION

NRL Problem CO2-03  
Project RR 007-08-44-5501

Manuscript submitted March 13, 1963.

<p>UNCLASSIFIED</p> <p>Naval Research Laboratory. Report 5945.  FRictionAL PROPERTIES OF POLYETHYLENES  AND PERFLUOROCARBON POLYMERS, by R.C. Bowers  and W.A. Zisman. 14 pp., and figs., June 4, 1963.</p> <p>Friction was measured at 25°C for steel sliding on  polytetrafluoroethylene (TFE), a copolymer of tetra-  fluoroethylene and hexafluoropropylene (FEP), three  high-density polyethylenes (HDP), and two low-density  polyethylenes (LDP) at a velocity of 0.01 cm/sec and  with a load of 1000 grams. The static coefficient of  friction (<math>\mu_s</math>) with a clean steel slider for all the poly-  mers and the kinetic coefficient of friction (<math>\mu_k</math>) for LDP  are of the order predicted by the adhesion theory. The  experimental values of <math>\mu_k</math> are much smaller than the  calculated values with TFE, FEP, and HDP because of</p> <p>UNCLASSIFIED (over)</p>	<p>UNCLASSIFIED</p> <p>Naval Research Laboratory. Report 5945.  FRictionAL PROPERTIES OF POLYETHYLENES  AND PERFLUOROCARBON POLYMERS, by R.C. Bowers  and W.A. Zisman. 14 pp., and figs., June 4, 1963.</p> <p>Friction was measured at 25°C for steel sliding on  polytetrafluoroethylene (TFE), a copolymer of tetra-  fluoroethylene and hexafluoropropylene (FEP), three  high-density polyethylenes (HDP), and two low-density  polyethylenes (LDP) at a velocity of 0.01 cm/sec and  with a load of 1000 grams. The static coefficient of  friction (<math>\mu_s</math>) with a clean steel slider for all the poly-  mers and the kinetic coefficient of friction (<math>\mu_k</math>) for LDP  are of the order predicted by the adhesion theory. The  experimental values of <math>\mu_k</math> are much smaller than the  calculated values with TFE, FEP, and HDP because of</p> <p>UNCLASSIFIED (over)</p>	<p>1. Polyethylenes - Friction</p> <p>2. Polymers - Friction</p> <p>3. Fluorocarbons - Prop.</p> <p>I. Bowers, R.C. II. Zisman, W.A.</p>
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Friction was also determined for FEP as a function of the load in the range 100 to 10,000 grams. Static friction was not proportional to the load and  $\mu_s$  increased rapidly as the load was decreased below 1000 grams. It was concluded that the real area of contact was not proportional to the load and that the deformation of contacting asperities was not completely plastic.

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